the patient gradually became comatose and expired at the end of the sixth day.

Autopsy.—At autopsy I found, besides an old softening in the right internal capsule, a recent hemorrhagic area in the white substance of the left prefrontal lobe (see illustration). Microscopic examination of the brain and the spinal cord shows the descending degeneration traced from the right internal capsule. It may be of some interest to know that the patient had a tendency to bleed easily and profusely on the slightest occasion. This factor probably was the immediate cause of the cerebral hemorrhage.

The present case is interesting therefore, because of the causal relations of a lesion in the left prefrontal region to the mental phenomena and because of the special character of the latter, similar to those observed by other authors. The euphoria of the patient was striking; he expressed a psychic childishness in his acts and words. Since an analogous symptom was observed by others, viz., *Witzelsucht, Moria,* and since in my case it was the most conspicuous phenomenon throughout the man's brief illness, perhaps it could be considered to some extent as pathognomonic of diseases of the frontal lobe. This contribution to the study of pathology of the prefrontal lobe adds a new, although not absolute, proof of the localization of the higher psychic functions in this region of the brain.

ACUTE OVERSTRAINING OF THE HEART.*

THEODOR SCHOTT, M.D.

FRANKFURT-ON-MAIN, GERMANY.

It is now about thirty years since Peacock, as a result of observations made by him on Cornwall miners, acquainted us with a special form of heart disease, the etiology of which he tried to connect with previous muscular straining.

His observations were confirmed later on by the investigations of Myers, Clifford Albutt, Da Costa, Joh. Seitz, Munzinger, etc. Nevertheless, there were other authors that did not admit of a condition of excessive heart-straining, or at least were very doubtful about it, as, for instance, v. Schroetter, E. Seitz and Strümpell. It was the investigation of Leyden and Fraentzel which again gave new impulse in this domain, and in one of my publications I was enabled to mention these observations of cases which correspond with those of both last-named authors.

We naturally have to distinguish between a chronic and an acute overstraining of the heart, and it is hardly necessary to mention that the first can result only from an accumulation of repeated single overstrainings; the investigation of the latter is, therefore, of extraordinary interest. Many former doubts have been dispelled by a series of observations (Leyden, Fraentzel and myself), as well as by a better knowledge of the physiology of the heart. Nowadays we possess a better knowledge of the innervation of the heart and are also better acquainted with the functions of the pneumogastric and sympathetic and of the extra- and intracardiac nervous centers —I refer, among others, to the coordination center of Kronecker-Schmey, etc. All this may help to clear many misunderstandings which may be of consequence in the different manifestations of heart-overstraining. The numerous investigations on the intracardiac as well as on the intravascular pressure command attention, also the exact determination of the time-limits of the rhythmic cardiac movements, and above all the reflex actions which may influence the activity of the heart from the lungs, the blood vessels, the abdominal viscera and other organs. Such investigations have become so numerous and so many well-known names are connected with them that it is impossible to mention them in detail and superfluous to report on the conclusions which have already become the common property of medical science.

Let us now consider the question whether or not an acute overstraining of the heart ever actually occurs. According to Leyden, Fraentzel and myself, we must admit of such a possibility. Still, in spite of all the histories of cases published so far, the objection was raised that the heart itself had already undergone some previous change either in structure or in function and that the subsequent straining was only a determining cause for further aggravation. Although former investigations, as well as a number of old and recent cases, left me hardly a doubt that a pure acute overstraining of the heart actually does occur, I considered it advisable to investigate this important question more closely. For through the solution of this problem we obtain definite conclusions regarding not only acute and chronic overstraining of the heart but also many other obscure points concerning the pathology of chronic heart diseases. On these grounds I have instituted a number of experimental investigations.

When we look at the literature we find, apart from the psychical influences which later on we shall also consider more closely, that all those causes which lead to an injury of the heart through bodily overstraining were referable to muscular actions of different kinds, such as the lifting or carrying of heavy burdens, dancing, straining marches, etc. These always had in common the one fact that a dyspnea of longer or shorter duration had invariably been called forth by the most varied muscular movements.

In order to study the influence on the heart of such muscular actions as lead to dyspnea I selected wrestling, which I had performed by healthy, strong men in such a manner that they alternately inhibited their movements by forcibly resisting each other or by each lifting his antagonist. I might also remark that for my experiments only such persons were selected whose clinical histories as well as local examinations showed them to be possessed of absolutely normal organs.

Before the wrestling began the heart limits and the point of the apex-beat were correctly outlined, sphygmographic curves and blood pressure registered, the position of the diaphragm and the posterior pulmonary limits located, the frequency of the respiration and of the pulse, the quality of the pulse-waves and of the heart sounds accurately determined. As long as no dyspnea appeared only an increase in the frequency of respiration and pulse were noticeable; everything else remained as before. But even a very few minutes after actual dyspnea had manifested itself the picture was changed. The heart limits were removed outward for 1 cm. or more; the apex-beat was shifted visibly and perceptibly toward the axilla; the respiration was often more than doubled, the pulse pressure, which at first was increased was ultimately reduced to the amount of 10, 20 and more mm. Hg, according to the increasing severity of the dyspnea. Both tables A and B illustrate this as well as other observations made during the wrestling.

As shown (Figs. 1 to 8), the increased cardiac pres-

* Read before Johns Hopkins Medical Society in Baltimore; Jefferson Medical College in Philadelphia; Medical College of Ohio and Medical Department of the University of Cincinnati.

sure manifests itself by arrhythmia, and we even notice a pause (Fig. 2), once after three, again after four pulsations; this has also been mentioned by Knoll in his investigations on the alterations of the heart-beats. In the experiments of which I speak the retardation could naturally not take place on account of the strong dyspnea, and it was obviously impossible to obtain curve-tracings of the pulse during the act of wrestling itself.

The relaxation of the vascular wall is very evident (Figs. 3, 4, 5 and 6), as this manifests itself by a greater ascension and stronger dicrotism (Sommerbrodt). Whether we have to deal here simply with an effect of a reflex action dependent on the magnitude of the intrabronchial pressure with conditions of irritation due to deficiency of oxygen or of accumulation of carbondioxid or with still other reflex relations, has not yet been determined.

We certainly possess in the vascular system itself a powerful factor which is able to interfere compensatorily; but this is possible only to a certain extent, beyond which it is no longer able to establish an equilibrium. Thus I have often seen that the strongly dilated heart is not longer able to send a sufficient quantity of blood into the arterial system even with accelerated and deeper respiration, the pulse becomes small (Fig. 8), even occasionally thready, the blood pressure falls excessively (as is also evident in the pulse-tracings), or the increased intracardiac pressure which is still present after a longer period of rest continues to manifest itself by arhythmia.

I should like to call special attention to the change in size which the heart undergoes, since this appears to me to be of great importance. I mean the dilatation of the heart which takes place to the right as well as to the left and which you may be able to recognize by the diagrams[1] (Figs. 14-19).

The following may be mentioned for clearer information: The heart limits in H. B. (which correspond also to Table A and the tracings in Figs. 1-6) were determined by a renowned colleague[2] well versed in the art of physical diagnosis by the ordinary percussion

TABLE A.**

H. B., masseur, aged 20; 196.5 cm. tall; muscles powerfully developed; little adipose tissue; all examinations show normal conditions.

Conditions.	Time. Hr.	Time. Min.	Kind of Motion.	Position of Diaphragm.	Respiration.	Pulse.	Quality of Pulse.	Heart Sounds.	Blood Pressure by Basch's Sphygmomanometer.	Apex Beat Seen.	Remarks.
Before wrestling.	4	33	.....	Upper margin of sixth rib.	16	84	Full, soft, not easily compressible.	All clear.	115 mm. Hg.	0.5 cm. int. to nipple.	
After simple wrestling.	4	45	After three rounds of severe wrestling.	.....	.....	150–160	Irregular.	Clear, irregular.	130 mm. Hg.	0.5 cm. ext. to nipple.	Dr. L. and I both note dilatation of 2 cm. of right ventricle.
	4	55	Continued wrestling.	.....	.....	168	Here and there some irregularity	Clear, irregular.	165 mm. Hg.		
	4	56	Renewed wrestling.	.....	.....	156	Here and there some irregularity	Clear, irregular.	100 mm. Hg.		
	5	8	Before wrestling.	Lower margin of fourth rib.	21–22	108	.....	.....	.....	.....	Positi'n of diaphragm shifted upward 2 cm.
Wrestling with belt tightened around the abdomen.	5	20	.....	.....	40–42	140–150	Full, regular.....	Clear....	.....	5.5 cm. ext. to mammillary line is perceptible in fourth intercostal space.	Feeling of palpitation and shortness of breath duri'g wrestling; no painful sensations anywhere.
	5	21	1 min. pause.	.....	40	140	Full, regular.....	Clear....	.....		
	5	22	1 min. wrestling.	Lower margin of fourth rib.	.....	144	Irregular.....	.....	.....		
During test without belt.	5	24	After 20 min. pause.	Upper margin of sixth rib.	18–20	96–100	Still irregular, full.	Clear....	100 mm. Hg.	.....	Feels well; no longer sensation of palpitation or shortness of breath.
	6	2	.....	Upper margin of sixth rib.	18	90	Regular.....	Clear....	95 mm. Hg ..	0.5 cm. ext. to nipple.	

** The exact measures of the heart-limits are apparent in the appended special diagrams. The blank spaces under their headings are due to the impossibility of noticing every symptom simultaneously.

TABLE B.

F. S., masseur, aged 45; muscles powerfully developed; moderate adipose tissue; all examinations show normal conditions.

Conditions	Time. Hr.	Time. Min.	Kind of Motion.	Position of Diaphragm.	Respiration.	Pulse.	Quality of Pulse.	Heart Sounds.	Blood Pressure by Basch's Sphygmomanometer.	Apex Beat Seen.	Remarks.
Before wrestling.	1	35	.....	Sixth rib.....	12	90	Full, soft, easily compressible.	Clear....	135 mm. Hg.	1 cm. int. to nipple.	
During and after simple wrestling.	1	38	Three min. wrestling.	Sixth rib.....	.....	126	.....	.....	140 mm. Hg.		
	1	44	After 4 min. severe wrestling and lifting.	Sixth rib.....	.....	135	.....	.....	115 mm. Hg.	3 cm. ext. to nipple.	Free perspiration; severe dyspnea.
	1	45	1 min. pause.	.....	36	128					
	1	57	12 minutes' pause.	Upper margin of fourth rib.	21	116	.....	Clear....	125 mm. Hg.	2.5 cm. ext. to nipple.	
Wrestling with tightened belt around the abdomen.	2	2	After 4 min. wrestling and lifting.	.....	.....	148	.....	1st heart-sound little muffled at apex; not cl'r.	105 mm. Hg.	5.5 cm. ext. to nipple.	Severe dyspnea; deep respiration impossible; cyanosis of face.
	2	5	After 3 min. pause.	.....	20	110	.....	.....	125 mm. Hg.	4 cm. ext. to nipple.	
During pause without tightened belt.	2	22	After 10 min. pause.	.....	14	104	Full, soft.....	Clear....	135 mm. Hg.	1 cm. ext. to nipple.	

1. These diagrams, as well as the above tables and series of curves, in all cases refer to the same two persons.

2. This colleague partly made all the observations referred to in the foregoing tables or tested their accuracy.

method, then also by myself according to my late brother's method of percussion with lateral limitations. These latter limits correspond to the total cardiac boundaries as has been fully demonstrated elsewhere. The cross near the nipple marks the place of the perceptible apex-beat in all cases. You will see by the diagrams how wrestling, when once it has called forth dyspnea, is able to dilate the heart, both to the right and to the left to the amount of 1 to 2 cm. and more. It is evident that this dilatation is produced only by the accumulation of blood in the cardiac cavities, a so-called congestive or passive dilatation having taken place. The ordinary method of percussion requires a cautionary measure. Then, when we percuss immediately after wrestling during the state of highest dyspnea, it may happen that we find not only no broadening of the originally determined heart limits, but even a transitory narrowing of these limits; in other words, the highly inflated lungs cover up the real heart limits. But after a short

Fig. 1.—H. B. (Table A), 4:33 p. m., before wrestling.

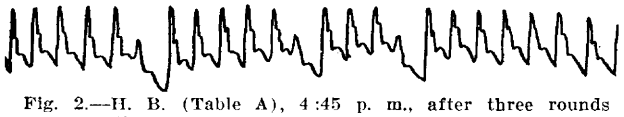

Fig. 2.—H. B. (Table A), 4:45 p. m., after three rounds of severe wrestling.

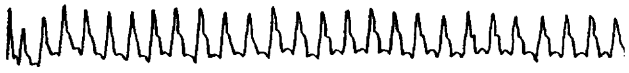

Fig. 3.—H. B., (Table A), 4:55 p. m., continued wrestling.

Fig. 4.—H. B. (Table A), 4:56 p. m., renewed wrestling.

Fig. 5.—H. B. (Table A), 5:22 p. m., after severe wrestling with tightened belt.

Fig. 6.—H. B. (Table A), 5:42 p. m., after 20 minutes' rest.

lapse of time (1 to 2 minutes) the real cardiac outlines appear; this proves that the extended dulness is not caused by a retrocession of the pulmonary margins, but that it corresponds to the real limits of the dilated heart-muscle itself. When the wrestling is allowed to be continued in such a manner that dyspnea is produced along with cyanosis a further lowering of the blood pressure may be observed besides the increasing dilatation as well as a still greater frequency of pulse, respiration, etc. The heart sounds, however, remained clear in both experiments, only in one instance was the first sound very dull at the apex.

Since it has been proved by various authors, among these v. Frey and Krehl,[3] that compression of the abdominal viscera with upward displacement of the diaphragm is of great influence on the amount of blood contained within the cardiac cavities, on the intracardiac pressure and on the activity of the heart in its entirety. I have instituted a second series of experiments, during which a belt was fastened about the bodies of the wrestlers below the costal arch and then tightened until they experienced the sensation of great constriction. In the wrestler H. B. (Table A) the diaphragm was pushed upward in this way to the amount of 2 cm. and in the wrestler F. S. (Table B) to the amount of 4 cm. Even this simple lacing of the abdomen was sufficient to call forth dyspnea and tachycardia. Especially the outward displacement of the apex-beat and the heart limits, as they have been determined by my colleague and myself before the wrestling, show how great an increase there was in the amount of blood in the heart cavities and how thus the clinical picture of acute dilatation had developed itself.

When the further wrestling movements were carried out energetically enough to lead to dyspnea the apex-beat was displaced very materially outward, in one instance even to the extent of 5.5 cm. beyond the mammillary line. Then the ventricles, and especially the auricles (see heart tracings), expanded considerably, all this within a few minutes. In the first case we have again an arrhythmic pulse; in the second, where I had to forbid severer wrestling on account of the greater cyanosis, only the smaller amount of blood in the radial

Fig. 7.—F. S. (Table B), 1:35 p. m., before wrestling.

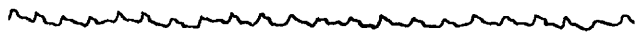

Fig. 8.—F. S. (Table B); 1:44 p. m., after 4 minutes' severe wrestling and lifting.

artery, along with regular rhythm, was observable. And here it was worthy of notice, that at the time of greatest heart dilatation and most marked dyspnea with cyanosis, the first sound at the apex was not accompanied with a murmur, yet it could not be called definite, being rather somewhat dull at a period when the left auricle had become extended to the amount of 3 cm. and the left ventricle to 2 cm., as compared to that which was already present during the pause, the wrestler still being laced.

For more explicit data concerning the frequency of pulse and respiration, the blood pressure, the heart extension, etc., I must refer to the accompanying tables and diagrams.

All the symptoms gradually recede again in healthy and strong individuals. With greater tightening of the abdomen and more intense wrestling, also when the dyspnea, eventually with the cyanosis and concurrently with a strong dilated heart was very marked, it required considerable time for normal conditions to reappear; in some cases I was even able to note a few abnormalities of heart and pulse, etc., after the lapse of two hours. In other cases where the group of symptoms does not develop itself so forcibly, it often happens that even after a short rest, entirely normal conditions are re-established.

Nowadays, through sport carried on to excess, we often have occasion to observe the effect of such excessive strainings on the heart, and bicycling is here of great importance. It was, therefore, of special interest to me

3. In their "Investigations on the Pulse" they describe this fact in the following words: "When in animals with opened thorax the abdominal viscera are being pressed against the diaphragm the heart may be seen to arch itself high up during its rhythmic pauses, the manometer in the artery showing a simultaneous increase of pressure. The pressure on the abdomen must be even and not too strong, otherwise the great afflux of blood to the heart brings about irregular beats. In the auricles especially a degree of repletion is easily attained which deprives them of the faculty of contracting, or at least allows only incomplete contractions. Ordinarily the rhythm of the ventricular beats is then also interfered with."

to study more closely the influence cycling had on the heart. To that effect I selected healthy, strong boys of the age of 13 to 15 years, who steadily bicycled, either on bad roads or on ascending grades or against strong winds. Pulse tracings showed the markedly increased frequency of the pulse, though all the boys felt well subjectively. In one case even we had arrhythmia, in another the pulse wave was very small or the elevation of elasticity scarcely recognizable. Here and there the systolic ascension amounted to only about one-third of that which the curves showed before the bicycling, the blood pressure being lowered; the heart expanded either in one or the other, or in both directions exactly in the same manner as shown in my investigations with wrestling. Here also all symptoms of heart insufficiency disappear in a short time after one single overstraining. In healthy persons this occurs sometimes after a few minutes, but when, by continued excessive sport, these symptoms frequently recur, they naturally increase in intensity and in duration, and then lead to the well-known chronic overstraining.

I also made such an investigation with a young bicyclist, 18 years old, who had a compensated mitral insufficiency. I had him run 10.6 kilometers in fifty-two

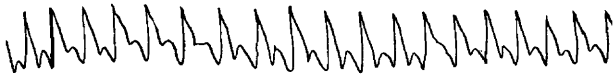

Fig. 9.—Cardiac neurosis; before bicycling.

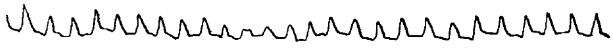

Fig. 10.—Cardiac neurosis; directly after bicycling.

Fig. 11.—Cardiac neurosis; after 1 minute rest.

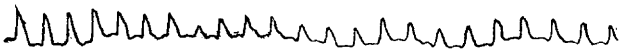

Fig. 12.—Cardiac neurosis; after 3 minutes' rest.

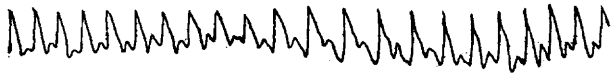

Fig. 13.—Cardiac neurosis; after 15 minutes' rest.

minutes on a bad, muddy road; here a still greater dilatation was manifested both to the right and to the left; this even persisted after one-half hour's rest.

The tracings are shown (Figs. 9-13) pertaining to a case of motor neurosis in a young man of 18 in whom rapid bicycling also caused a strong cardiac dilatation, a small pulse and strong palpitation; and even after fifteen minutes the sensation of cardiac fatigue had not entirely vanished.

In recent years I have also tried to investigate acute heart straining by means of the Roentgen rays. I have also succeeded, with the ordinary precautions, in showing the changes of form already mentioned. This procedure is easily carried out by means of the fluorescent screen. These changes of form naturally disappear rapidly in healthy individuals.

On the ground of their orthodiagraphic investigations, Moritz and Hoffmann denied these cardiac changes due to acute overstraining. But the fact that for the purpose of carrying on their investigations they placed the subjects in a horizontal position and the uncertainty, whether this position was always exactly the same before and after the experiment, make the method unreliable. Then the fact that the overexcited heart is able to undergo strong lateral deflections in the supine position also gives the possibility of error. My experiments have been fully confirmed by the observations of Starck, Baldes, Heichelheim and Metzger regarding the influence of great bodily straining on the circulatory apparatus, the kidneys and the nervous system. The last-named authors found that in persons from 17 to 27 years old, who had previously been examined and found to be healthy, the former normal heart limits had undergone a considerable expansion after a march of 100 kilometers, within one day and with hardly a rest; a few of them had not even resorted to the use of alcohol in any form. The

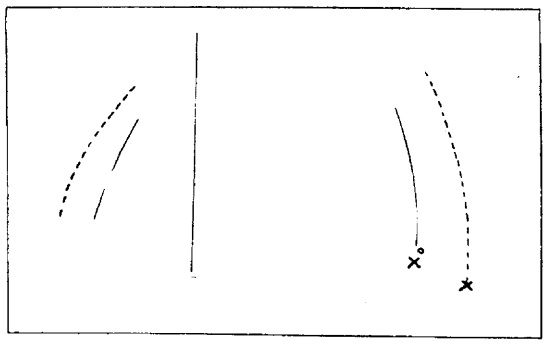

Fig. 14.—Heart-outline tracing of wrestler H. B. (Table A). Simple wrestling; percussion with lateral limitation. Solid curved line; heart-outline before wrestling; broken line, heart-outline after wrestling; the x represents the perceptible apex-beat.

frequency of the pulse was markedly increased, and the blood pressure considerably lowered in all the subjects of experiment, in some cases even to the amount of 25 per cent.

I trust I have proved by the above described experiments that acute overstraining of the heart really does occur, even in healthy individuals; in the latter this naturally disappears readily. In what manner and how rapidly normal conditions may again be re-established is a matter which depends essentially on the elasticity of the tissues, on the compensatory arrangements gov-

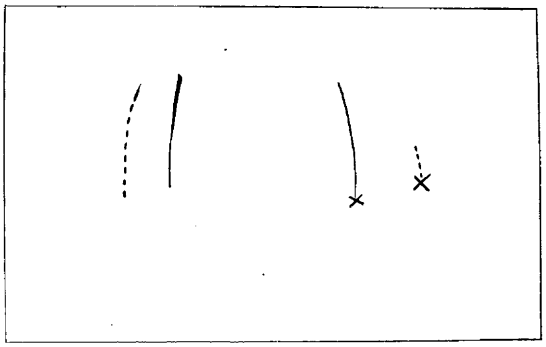

Fig. 15.—Same as Fig. 14 only ordinary percussion.

erning the vascular system, etc. Further experiments will have to determine what are the extreme limits of overexpansion of the heart, where the cardiac muscle has lost its normal capability of contraction. According to my experience, these limits seem to lie far apart in the living muscle in healthy, and especially in young, individuals. The same applies to the vasomotor compensatory appliances. With older persons when the tissues, especially the muscles, have lost a considerable part of their elasticity and the vascular walls have acquired a certain degree of rigidity another condition prevails. Here one single and rather trifling overstraining may

call forth permanent deteriorations, as clinical histories illustrate. And when further pathologic changes of the tissues, and especially of the heart itself, have taken place this organ becomes exposed to the dangers of overstraining to a still higher degree.

When even a healthy heart may be injured by an acute overstraining, how much easier must this be the case in a heart-muscle which is already diseased or whose nutrition or innervation has already been interfered with by disturbances of all sorts.

I was interested in knowing whether an acute overstraining of the heart was also possible in animals. Professor Schütz, pathologic anatomist of the Veterinary College at Berlin, has made inquiries for me of several

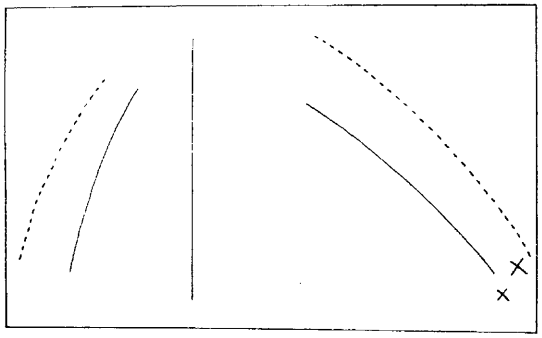

Fig. 16.—Heart-outline tracing of wrestler H. B. (Table A). Wrestling with tightened belt around abdomen; percussion with lateral limitation. Solid curved line, heart-outline before wrestling; broken line, heart-outline after wrestling; the x represents the perceptible apex-beat.

pathologic anatomists and veterinary surgeons. From the answers received and collated by me it is apparent that an overstraining of the heart does occur in animals, especially in horses and hunting dogs. But the physical examinations of the heart in animals meet with so many obstacles and the clinical observations are so difficult that it is easily understood why conclusions in this matter differ so much. Nevertheless so much may be gathered from all reports in question that overstraining in animals may also lead to dilatation of the heart and to

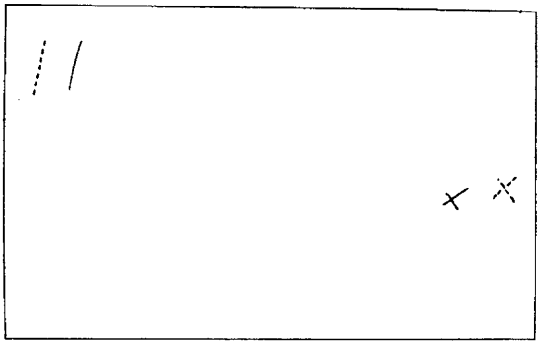

Fig. 17.—Same as Fig. 16, only ordinary percussion.

valvular insufficiency (mostly of the tricuspid, less frequently of the mitral valve) which later on may disappear entirely. Irregular and unequal pulse and similar disturbances appeared in the same manner as in man.

So far as exact investigations have revealed, rupture of the aorta was always the cause of sudden death in horses during racing, whereas an overdilatation of the heart-muscle never could be noted postmortem. The latter instance seems to find an explanation in the fact that in race horses the heart-muscle shows an extraordinary degree of development, and it is certainly of interest to learn that the heart of an English full-blooded race horse weighed 13½ pounds, whereas the normal heart of a common horse nearly twice as heavy only shows a maximal weight of from 8 to 10 pounds. Such a hypertrophied heart-muscle might easily be able to overcome even severe overstraining without being subjected to the dangers of overexpansion.

The prognosis depends above all on the age, the degree of overstraining, the nutrition and the occupation of the patients as well as on pre-existing complications. The more elastic the tissues, the better the nutrition and the care of the patients, the quicker will the disturbances disappear and normal conditions re-establish themselves. Patients that are run down or are compelled to contin-

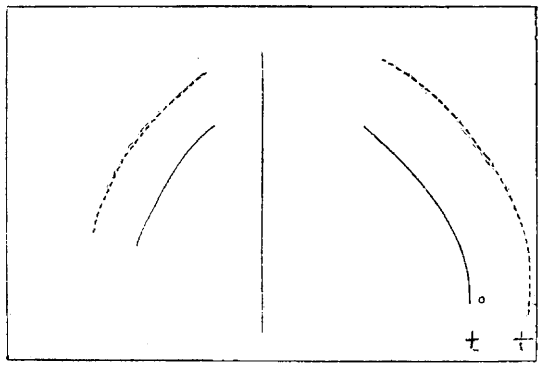

Fig. 18.—Heart-outline tracing of wrestler F. S. (Table B). Simple wrestling; percussion with lateral limitation. Solid curved line, heart-outline before wrestling; broken line, heart outline after wrestling; the x represents the perceptible apex-beat.

ually expose themselves to noxious influences, those also in whom valvular lesions, alterations of the heart-muscle, arteriosclerosis or other deteriorations are present, not only need a longer time for recuperation, but are also exposed to the danger that irreparable damage may be done.

As far as therapeutics are concerned it is hardly necessary to dwell on the fact that after an acute overstraining of the heart absolute rest is the first indication. Even the simple raising of the body in bed may call forth an

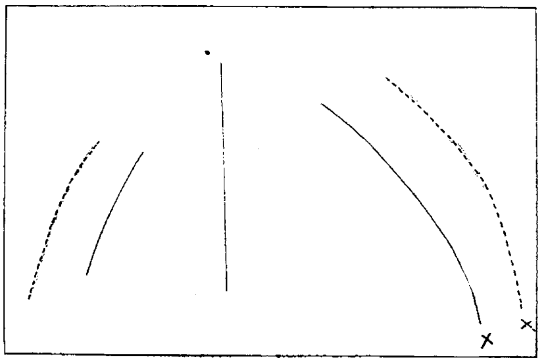

Fig. 19.—Same as Fig. 18, only wrestling with a tightened belt around abdomen.

aggravation. When an examination of the posterior parts of the lungs is required this should be made in the lateral position. Strong nutrition is always of importance.

Among medicines digitalis takes the lead; no substitute of any kind can approach it. For quieting the action of the heart the application of ice or of sinapisms on the anterior pectoral surface is indicated. It will hardly be possible to dispense with the use of morphin in order to alleviate the severe pains in the cardiac region, nevertheless it is advisable to be cautious in the

long continued use of large doses of this drug. I have had many cases where I was able to dispense with morphin and to replace it with the application of heat. All data concerning the above I have repeatedly given in some of my writings. The use of stimulants is indicated in excessive cardiac weakness and in threatened heart failure.

When by such therapeutic means we have succeeded in saving the patient from the threatening condition and when recovery from the injuries already present has taken place, it might be advisable to resort to tonics to counteract the heart weakness, this being liable to persist for a considerable time. Here also a generous nourishing of the patient is one of the most important tasks of the physician. A rational balneologic treatment, the careful use of gymnastics, suitable exercise in the fresh air, with the avoidance of any kind of straining, all come into consideration.

I shall now give the clinical histories of a few cases bearing on the subject.

CASE 1.—Farm laborer, 24 years old, came to me in August, 1879. Excepting the measles, the patient claimed never to have had any illness; he disclaimed using spirituous liquors to excess. He was of short, compact figure and gave the impression of being a strong man with well-developed muscles and but little adipose tissue. About four hours before he came to me he had been busy lifting several heavy sheaves of wheat at a time with a pitchfork instead of only a lesser quantity, as he had been used to do. These sheaves were heavy, even to raise from the ground, and when he came to lift them higher he had to drop them on account of sudden pains in the chest, dizziness, etc. The man rested for a short time and tried to raise a smaller load, but this also was impossible, for not alone pain but palpitation of the heart and dyspnea interfered. It even forced the patient to lie down. Since the symptoms did not cease he came to me four hours later, led by a friend. It took him about two hours for a walk of about twenty to twenty-five minutes on a completely even road. Walking caused great disturbance, and only with difficulty did he succeed in mounting the stairs to my apartment. The status was as follows: Facial cyanosis, marked dyspnea, small pulse; on investigation of the thorax the strong ictus cordis was very striking, apex beat could be felt outside of the mammillary line. The heart was dilated both to the right and to the left, heart-sounds clear. Patient was taken home in a carriage, was given digitalis, absolute rest being enjoined and strengthening nourishment being prescribed. The following day he only complained of palpitation and the second following evening he felt perfectly well, resting quietly in bed. Objectively I found the heart action still somewhat increased, though two days later an examination again revealed normal conditions. Nevertheless, the patient was not yet able to work because any kind of straining immediately called forth palpitation and shortness of breath, so that he left for home. I never learned anything further about him.

CASE 2.—B. F., aged 15¼, had always enjoyed good health and was said to have grown very rapidly of late. It was claimed that he was insufficiently nourished, even while undergoing considerable mental straining, still he never complained of being weak or not being well. For several years the patient rode a bicycle without noticing anything; in the beginning of the present year he began tricycling, which strained him considerably more. Once in the beginning of this year, having ridden more than two hours on his tricycle, he complained of an attack of dizziness and claimed to have perceived a purring noise in the region of the heart. This, however, was said to have disappeared spontaneously in a short time. A few days later he strained himself considerably by a long ride uphill on a steep and very bad road. In consequence of this not only did that purring noise in the cardiac region recur during the ride, but he experienced attacks of dizziness and fainting spells and had to dismount and lean against a tree. In this condition he was found and it was only with assistance that he could find his way home. The examining physician found a cardiac dilatation along with a systolic murmur at the apex, which, however, is said not to have been heard any more after a few days. The patient is said to have been very pale in the early stages. A few days later, when I first saw the young man, he complained only of dizziness. In the examination the cardiac hyperkinesis was very evident, the heart being still dilated to the left to the extent of 1 to 1.5 cm. With absolute rest and a strengthening diet, combined with slight resistance-exercises, complete normal conditions set in within a few weeks, and with proper care he remained in good health, as was reported to me some months later.

When we consider both of these cases we find that we have to deal with persons that had always enjoyed good health. In the first of these cases one single stronger bodily straining sufficed to call forth dilatation, tachycardia, dyspnea, etc.; in the second case these effects were produced by a preliminary smaller, followed soon after by a much greater strain, this being excessive for the youthful, mentally overworked and badly nourished organism. Acute overstraining of the heart takes place much more easily when the heart, through preliminary or existing alteration of the total organism, has already been disturbed in its nutrition or innervation.

CASE 3.—F. H., aged 18, was under my treatment from May 15 until June 27. Apart from measles at 8 years of age, she was always well until the previous year, when she complained of great fatigue, her physician diagnosing chlorosis. This chlorosis improved, but did not disappear entirely. She could climb hills without disturbances of any kind. Four months ago the young lady danced all night, and she admits having been tightly laced and the hall having been oppressively hot. Sometimes during dancing she had a sensation of darkness before the eyes, she experienced palpitation and shortness of breath. Nevertheless, and in spite of this group of symptoms constantly increasing in intensity, she only desisted from further dancing when she found herself compelled to drive home. The disturbances persisting, the following day the patient had to keep in bed. Her physician then noted the existence of a dilatation of the heart, and gave digitalis, also iron. The condition improved, yet walking sufficed to again bring on palpitation and shortness of breath. When I saw the patient there was still a dilatation of the left ventricle, amounting to 1.5 to 2 cm.; some chlorosis was still present. With suitable baths and gymnastic treatment, a diet rich in albumin and fat, seven more weeks elapsed before normal conditions could be ascertained. Since then the patient's health remained undisturbed. She married and went through four confinements without the occurrence of any further heart trouble.

Here also we find the one solitary severe straining calls forth the same group of symptoms, the essential difference being that this one single injury of the heart —and I have seen several such cases in chlorotic girls resulting from dancing—caused disturbances that lasted several months. It certainly must be considered here that the long duration of those symptoms is to be ascribed in a great measure to the anomalous composition of the blood and, as evidenced by my experiments, to tight lacing. It is not impossible that the narrowness of the aorta so often found in chlorotic patients and which by itself increases the labors of the heart may also be considered as a factor in the quicker production of cardiac overstraining.

Of course, cases of overstraining of the heart are apt to be followed by much more serious consequences where a severe cardiac or valvular lesion already exists. Such lesions often lead to long invalidism, sometimes even to rapid dissolution.

Similarly to bodily straining strong emotional disturbances, especially fright, may also act suddenly on the heart. Although I have at my disposal many clini-

cal histories of cases bearing on the subject, I must refrain from considering this matter any further at present, it being somewhat too far removed from my present theme. I hope, however, to be able to report on this very interesting chapter in cardiac pathology.

Clinical Notes

EXTENSIVE AVULSION OF SCALP.

REPORT OF A CASE TREATED BY PLASTIC REPAIR AND FOLLOWED BY TETANUS WITH RECOVERY.

H. A. HAUBOLD, M.D.
Professor in Clinical Surgery, New York University and Bellevue Hospital Medical College, Surgeon to Harlem Hospital.
NEW YORK CITY.

The case forming the text of the following communication illustrates certain points in the treatment of conditions which, while not frequently met, may and do occur in the practice of most surgeons, and, although no new principle is submitted here, the application of accepted ones deserves mention. Following so closely on the excellent summary[1] of the treatment of tetanus with serum by Jacobson of Syracuse and Pease of Albany, a discussion of greater length in this connection would burden unnecessarily the literature and serve no useful purpose. In looking over the cases forming the basis of Jacobson's and Pease's work, it would appear that they, like all of us who compile and deduce from the publications of others, were confronted with the fact that most important details are lacking in the reports of cases submitted by the various authors, and if this contribution seems somewhat protracted it must be ascribed to my desire to escape the fault of inaccuracy which may be the outcome of an effort to be brief.

Patient.—B. S., aged 7, was admitted to Harlem Hospital July 16, 1906.

History.—On the day of admission the patient had been knocked down by a trolley car, the fender of which pushed the lad along for a considerable distance, his head was ground along the rail and the scalp torn off from the left side of the skull.

Examination.—This disclosed a denuded area measuring about four by five inches. The wound was symmetrically egg-shaped and the periosteum corresponding to the surface indicated was also avulsed. The edges of the wound were deeply stained with the mixture of mud and grease which covered the street in the vicinity of the car rails. There were many contusions over the entire body, but at no place, other than the scalp, was the skin broken. There was considerable shock, but no evidence of cerebral involvement and no bones were broken. Reaction from shock was rapid and complete in a few hours.

Operation.—The wound was cleansed and dressed in the usual manner, and eight days after admission a plastic operation for repair of the scalp was made. The entire wound, fortunately, was within the hair area of the scalp, and permitted of the application of a flap-sliding method practiced by Volkmann and Messner. A study of the accompanying illustration will make the method employed sufficiently clear to render unnecessary further attempt at elucidation in the text. Mention may be properly made here, however, that early plastic operative effort, in injuries with considerable loss of substance, is a wise measure and should perhaps be more frequently performed than is usually done. More especially is this the case when ultimate cosmetic effect plays an important part in the problem presented. In this instance the flaps were all taken from portions of the hairy scalp, so that, when healing had taken place, there was no visible evidence of the injury. In this case delay may have seemed permissible on the ground that necrosis of bone would be the result of the loss of periosteum. It is, however, to be remembered that the external table of the calvarium is supplied with nutrition by the diploë, and that extensive necrosis rarely follows even severe and extensive injuries to the scalp and periosteum. Indeed, this is what happened in our case, if the rapid repair of the injury is to be regarded as an indication of the absence of this complication. There were no disturbances of importance following the operation, and repair seemed to progress satisfactorily.

Postoperative History.—On August 3, nineteen days after receipt of the injury, the patient complained of pain in the throat and inability to open the mouth fully. Up to this time the rectal temperature had been about 99.5 F., and indeed showed no increase at this time, but the pulse rate, which had up to this been about 80 per minute, rose to 98. The latter symptom we regarded as indicative of the first expression of toxemia.

The following day the mouth was firmly closed, but could be opened sufficiently for the purpose of taking food. While protruding the tongue for inspection a spasm of the muscles of mastication caused the tongue to be bitten. The pulse rate remained near 100, but there was still no rise of temperature beyond that mentioned.

August 5, about forty-eight hours after the first manifestations, the temperature rose to 103 F., and several convulsions of moderate severity occurred in rather rapid succession; the rigidity extended to the entire body and the pulse rate rose to 128 per minute. There was no disturbance of cerebration. The wound, which up to this time had been healthy, lost its bright red color; the granulations looked flabby and there was some secretion, but no pus, discharged from the raw surfaces. The line of union of the flaps remained firm, however, and did not at any subsequent period break down. I concluded that this was a clear case of tetanus, which, because of the long period of incubation (nineteen days), its gradual development and rather moderate expression, would probably run a rather favorable course. On this day the house surgeon administered antitoxin in two injections of 7 c.c. each into the buttock and one injection of 10 c.c. into the spinal canal. In the latter instance about an equal amount of spinal fluid was previously withdrawn. During the night an injection of 20 c.c. into the spinal canal was made.

August 6 the rectal temperature was about 103 F., and the other symptoms about the same. There was rigidity and occasionally a slight general muscular spasm, but the mouth could be opened for nourishment. Twenty c.c. of the antitoxin were injected into the spinal canal.

August 7 Dr. S. J. Meltzer saw the case with me. The temperature was still about 103 F., and the pulse rate 138 per minute. There was rigidity of all the muscles, but no distinct opisthotonos. The mind was clear; there were some sordes on the lips and the cornea was dull. The patient at this time had received 14 c.c. of the antitoxin injected into the buttock and 50 c.c. injected into the spinal canal, in four days. I had Dr. Meltzer see the case with the view of determining the advisability of making injections of magnesium sulphate solution into the spinal canal.

Following the publication of Meltzer's experimentation with magnesium sulphate injections into the spinal canal for the purpose of producing anesthesia and my own observations on human beings, Blake of New York City had used the salt in tetanus and found that spasm was controlled as the result for from twenty-nine to thirty-seven hours.

After examining our case, it was concluded that there was no special indication for the use of the magnesium sulphate, as spasm was not a marked symptom, and that if any unfavorable outcome was to be anticipated, it was probably more as a result of a general enfeebling toxemia, which seriously interfered with metabolism, and not as the outcome of a specific effect on the central nervous system. It is this conclusion which perhaps makes the report of this case valuable. All of us are inclined to look at our cases from the standpoint of what generally happens, and may thus be led to employ a measure which has a distinctly important office in most cases

1. Ann. of Surg., September, 1908.